(37)

PB 131632-36

# SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

October 17, 1958

U. S. DEPARTMENT OF COMMERCE
Office of Technical Services
Washington 25, D. C.

Published Weekly from February 14, 1958, to January 2, 1959
Subscription Price $10.00 for the Series

PLEASE NOTE

This report presents unevaluated information on Soviet Bloc International Geophysical Year activities selected from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

# SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

Table of Contents

# I. GENERAL

## Review of the Polish Geophysical Year

The following is the account of an interview granted the Warsaw daily Zycie Warszawy by Prof Dr Stefan Manczarski, member of the Polish IGY Committee, in which the professor reviews Polish participation in the IGY to date:

Polish scientists have several achievements to their credit. Among the more important are the following:

Solar Research

Professor Mergentaler of Wroclaw proved systematic deviations from linear dependence among the different indices of solar activity. These systematic deviations depend on the phase of the cycle of solar activity.

The Ionosphere

Our particular interest in this field has centered on the scattering of electromagnetic waves in the upper layers of the ionosphere (Prof S. Manczarski). It appears that this scattering plays a more significant role than was hitherto presumed.

Poland was the first to advance the thesis that there is a scattering of short waves between ionospheric layers (Professor Manczarski and Docent S. Jasinski). Just a few years ago this hypothesis was received with some doubt at the conference of the Consultative Committee on International Radio communications held in Warsaw. Now, however, the theory is considered legitimate and is being discussed in US articles.

The third interesting subject of ionospheric research in Poland is the studies which have been started on short-wave propagation beyond the orthodrome (Professor Manczarski). The reason for this phenomenon is being sought in the billowing of the ionospheric ceiling (Martyn-Lamb waves) and partly in the scattering phenomenon. Very interesting studies in this field have been made by our expeditions in Vietnam and Spitsbergen. We were able to record a significant inclination of the ionospheric ceiling at our station at Miedzyszyn below Warsaw (Docent Jasinski). This ionospheric station was lent Poland by the USSR.

Seismology

Interesting microseismic research has been started, on the initiative of Professor Manczarski, on correlation of microseisms with dispersion of tropospheric radio waves. A positive, though minute, coefficient of correlation was obtained. This field is important for meteorological and radio prognoses.

As for the seismic research being done in the area of Upper Silesia, a seismically active area of dislocation has been discovered, along the length of which earthquake foci are distributed (Professor Janczewski).

Geodesy and Cartography

Among the numerous studies and measurements being made, the line surveys or measurement of the differences in the geographic distance between Borowa Gora and Potsdam, Prague, Budapest, and Sofia is distinguished by a high degree of accuracy. This work is being conducted by the Institute of Geodesy and Cartography in cooperation with interested scientific institutes in other countries.

Another specific achievement of the institute of Geodesy and Cartography is the correction of gravimetric measurements to study the earth's configuration, the establishment and measurement with a high degree of precision of a basic network, and the establishment of a base for the calibration of gravimeters.

Rotation of the Earth and the Earth's Crust

Cooperation between the astronomical station of the Polish Academy of Sciences in Borowiec and the latitude station in Irkustsk yielded very interesting results. These stations are located at the same latitude separated by 90 degrees, optimum conditions for determining the coordinates x and y of the magnetic pole.

A very accurate time service is also maintained at Borowiec using three quartz clocks and a Shortt clock. Borowiec also conducts gravimetric studies of changes in gravity as the result of lunar and solar influences, as well as the observation of directional changes in the vertical lines (linie pionu) (variations of the Lettau type).

The Warsaw Polytechnic (Professor Opalski) and the Main Office of Surveys (Docent Zajdler) have also joined in the work being conducted by Professor Witkowski.

Artificial Satellite Observations

A total of ten visual observation stations are in operation in Poland. Four of these stations use the optical barrier method; the others used varied methods resulting in varying degrees of accuracy.

One of our stations (Zegrze) also conducts systematic monitoring of the radio signals. Very valuable material has been collected on the propagation of radio waves from Sputnik III.

The USSR has lent us 80 telescopes in connection with our observations.

Many institutes are taking part in satellite observation and the Ministry of National Defense has provided very important aid.

Field Expeditions

One of the most interesting observations at Spitsbergen was made by Candidate of Science Birkenmajer concerning the very rapid rise in the land level of Spitsbergen. The land has risen about 8 meters in the vicinity of Hornsund in the past 350 years. This was proven by a very interesting method -- observation of whale bone layers.

A second observation made at Spitsbergen was the appearance of climatic oscillations in the glaciers near Hornsund fiord (Professor Kosiba). These observations indicate the beginning of a cooling trend in the climate of Spitsbergen. This news, a sort of scientific revelation, has aroused significant interest abroad.

An expedition is conducting studies in cooperation with the Vietnamese Democratic Republic of Vietnam at two stations: Chapa and Phu Lien. These stations were jointly organized and are jointly administered by the Vietnamese IGY Committee and the Polish Geophysical Committee.

The research at these stations includes studies in meteorology, aerology, actinometry, atmospheric electricity, magnetism, the ionosphere, radioactivity of foreign particles in the air and of rainfall, and seismology.

In aerology the expedition is studying the upper atmosphere to a height of about 30 kilometers (balloon and radiosonde). On the basis of data obtained, research is being conducted on certain peculiarities of the vertical temperature profile. Among other things, the existence of a second tropopause was affirmed, as well as violent fluctuations of the temperature and humidity of the air at a height of 4-5 kilometers. Moreover, interesting tests were conducted on the vertical atmospheric depth of the long wave (fala przeplywowa), which is especially strong in the equatorial zone.

The observations of the magnetic station at Chapa support the assertion of Soviet Candidate of Science Troitskaya that pulsations of the Earth's magnetic field appear most frequently at the moment the magnetic poles cross the central meridian.

As for the study of magnetic storms, the expedition was able to investigate several magnetic storms which yielded data on the mechanism involved in the development of the first and main phases of the storms. The first phase involves a several-hour buildup of the magnetic field, and the main phase, a several-day decrease in the value of this field. The interesting several-minute break separating these two phases is the present subject of our research (Magister M. Kozlowski). This problem is unexplained by existing theories and it would appear that the ionosphere has a part in the mechanism of the storm and is responsible for the abovememtioned break [between the two phases].

General seismic observations are also being carried on in the Far East aiming at a new theory on the origin of great dislocations in the island archipelagos and ocean depths. This theory, prepared in Poland by Professors Teisseyre and Droste will explain the dislocation mechanism of earthquakes and their energy.

Hydrographs of seismic waves have also been calculated for the first time for the Indochina region. They are basic to seismic research.

Any review of Polish achievements in the IGY must include mention of the extensive cooperation with other countries. For instance, in Spitsbergen at Hornsund, we are carrying on observations synchronized with the Soviet station at Barentsburg. We are making these observations with the aid of an all-sky camera received from the USSR. Also in Spitsbergen, we are coordinating our studies of the course of atmospheric disturbances with the Swedish-Swiss-Finnish station at Murchison Bay. The sunset tables of Professor Lugeon published in Poland last year were valuable in this work.

Poland is also conducting cosmic ray research with Czechoslovakia at Lomnica.

Many young scientists were sent to scientific research centers in the USSR (radio astronomy), Finland (aerology), West Germany (precision surveying), Sweden (magnetism), and Norway (aurora borealis).

In connection with cooperation with the USSR, two ionosondes were set up in Poland. Continuing cooperation with China was established in connection with our expedition in Vietnam. Cooperation with Norway has been initiated in the field of meteorology, of the aurora borealis, and terrestrial magnetism.

A permanent service for the observation of artificial satellites has been organized.

Poland, for its part, has assisted other countries. The Mongolian People's Republic was assisted in starting astronomical research by the gift of a zenith telescope, while the Democratic Republic of Vietnam has also received important aid from Poland.

As a result of the IGY program, the study of many subjects not previously covered in Poland has been initiated, including radio astronomy. Two radio astronomy stations have been established from funds provided by the IGY Committee: the station in Torun under Professor Iwanowska, which operates on meter-wave range, and the station in Krakow under Professor Koziel, which operates on decimeter-wave range. Moreover, the stations in Borowiec below Poznan, the station in Wroclaw studying solar activity, and the geophysical station in Bielsk below Warsaw have been expanded considerably. Finally, research has begun in fields such as sounding the ionosphere, the radioactivity of dust, measurement of carbon dioxide in the air, the aurora borealis, luminescence of the night sky, and many others. Our entire network of measurement stations has been improved, scientific reporting has been speeded up, and several score scientific works are being prepared, not only on geophysics, but also on certain selected fields of natural science connected with our expeditions. The bulk of the material collected is still being processed and will significantly enrich Polish scientific lore in many fields. ("Polish Balance Sheet of the Geophysical Year," by Prof Dr Stefan Manczarski; Warsaw, Zycie Warzawy, 26 Jul 58, p 5)

Czechoslovak Participation in the IGY

The participation of Czechoslovakia in the IGY program is described by Dr Zdenek Svestka, Institute of Astronomy of the Czechoslovakian Academy of Sciences at Ondrejov, in an article, "In Ondrejov," which appeared in a Soviet popular science monthly.

One of the most active stations, says Svestka, is the observatory of the Institute of Astronomy of the Czechoslovakian Academy of Sciences in Ondrejov, near Prague. During the first half of the IGY 310 chromospheric flares were successfully observed; this is, therefore the second station in the world for the observation of these manifestations of solar activity. The foremost station engaged in these activities is the German station located on the island of Capri, where incomparably better meteorological conditions exist. Simultaneously with the observation of chromospheric flares, radio emissions from the Sun are studied at Ondrejov, and in cooperation with the observatory imeni Doc Hermana Otavska in Cernosice, the investigation of prominences is conducted.

The results of observations are reported daily to the collection center at Pruhonice. From there, they are sent to Moscow and to the West European regional center, where observations obtained in stations all over the world are reported. The organization of information is so well planned that generalized data on chromospheric flares observed in the morning are received by the evening of the same day at Ondrejov.

Forecasts of solar activity for the following day have been made on the basis of information concerning chromospheric flares on the Sun, the recording of radio emissions from the Sun, and other phenomena. During the first 6 months of IGY, 160 code signals on chromospheric flare observations and 236 code signals on the recording of solar radio emissions on wave lengths of 56 and 130 centimeters were sent from Ondrejov to world centers. Information collected during 14 days, or during a month, are sent simultaneously to several centers. Each summary has as its aim the explanation of the status of a specific part of the work. More detailed data with photographs are sent to Frieburg, Germany, and to Pulkovo, USSR, where detailed maps of the solar surface with all of its spots, faculae fields, flares, prominences, and the form of the solar corona are compiled on the basis of these data. Sunspots are studied in many other Czechoslovak observatories (mainly by the photographic method) besides Ondrejov, primarily in the observatory of the Slovak Academy of Sciences in Skalnate Pleso and the observatories in Kromeriz, Presov, Prague, Pilsen, and Valasske Mezirici. During the first 6 months of the IGY, 400 photographs of the Sun's surface were made at these observatories. Of these, most were made at Kromeriz, Presov, and Ondrejov. The time of photographing is regularly reported to the center at Kislovodsk, USSR. The photographs are stored at specified observatories but are at the disposal of astronomical stations of all countries. ("In Ondrejov," by Doctor Zdenek Svestka, Institute of Astronomy, Czechoslovak Academy of Sciences at Ondrejov; Nauka i Zhizn', No 8, Aug 58, pp 37-38)

## II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

### Soviet Scientist Discusses Satellite Orientation Problems





V. G. Petrov, Candidate of Technical Sciences, writing in the article, "Orientation in the Cosmos," says, "Many scientific problems are being solved with the aid of Sputnik III. The investigation of flight conditions in the cosmos, and, in particular, the orientation of a satellite in space occupy an important place among them."

An object of any shape can, under the influence of initial or external disturbances, be freely shifted in space or rotate around its own axes. To prevent this, it is necessary to orient the axis of the body, in this case an artificial earth satellite, in a fixed direction. Stationary control or reference points in space must first of all be selected. Through them, it is possible to determine the magnitude of the angular declination of the axis of a free body relative to the preselected reference body. Suitable reference points can be, for example, the Sun, Moon, bright stars, and also the Earth, the Earth's magnetic field, etc.

The angular orientation of a free body in terrestrial space is either complete or partial. By the former, rotation is prevented relative to all three of its axes, while orientation of a free body's major axis relative to any reference body in terrestrial space is designated as partial. The major axis is that axis which passes through the body's center of mass and is directed toward the reference body.

Among the disturbances which affect a free body's motion are the initial disturbance (angular velocity) imparted to it at the moment of separation from the carrier rocket, the impact of meteorites, and the moment of rotation from the friction of the body in the denser layers of air at perigee. It is possible to create the desired and economical system for the orientation of the body only if exact data on such disturbances is known.

At present, says Petrov, there is no fully oriented satellite. Such a satellite is still in the initial stages of development. For the first time in the world, a magnetometer, a measuring transducer, which was automatically oriented, was installed in Sputnik III. Two other transducers made it possible to determine the position of the Sputnik's body relative to the Earth's magnetic field and the speed of rotation of the satellite around its own axis. These extremely important data, which, up to now, were impossible to obtain, permit the construction of an orienting satellite in any plane.

The orientation of a satellite is necessary for a more full and effective solution of a whole series of scientific and practical problems for the investigation of the Sun, the upper layers of the atmosphere, electric fields, micrometeorites, and the Earth's magnetic field. Orientation is also necessary for photographing the surface of the Earth, for the return of a satellite to Earth, ocean navigation of ships, airplanes, and future interplanetary craft. Not only the satellite but also almost all its instruments used for scientific observations require, for their operation over a long period of time orientation relative to various reference bodies located in terrestrial space. An example of one of these instruments is the solar battery.

Orientation of the satellite can be accomplished by using small jet motors as has been done already for the stabilization of geophysical rockets.

A second method of orienting a satellite is accomplished, with the aid of gyros located along its axes. A combination of the two methods is obviously the desirable system.

A satellite, like a rocket, must maintain a strictly determined position in flight, automatically determine its own position in space and in relation to the Earth's geographic coordinates. An inertial-celestial guidance system can be used for this purpose.

The selection of the type of system for orientation of a satellite depends on the nature of the reference points selected. A magnetosensitive transducer, or a photoelectric unit, or a gyroscope may be used as one of these systems. The magnetosensitive transducer has already been used in Sputnik III for orienting its magnetometers.

The use of a photoelectric element in artificial Earth satellites has the greatest prospective, because of its small size and weight and because it can ensure high accuracy of orientation. ("Orientation in the Cosmos," by V. G. Petrov, Candidate of Technical Sciences, Nauka i Zhizn', No 9, Sep 58, pp 7-12)

USSR Has Solved Problems in Construction of Automatically Controlled Satellites

"According to Agence France-Presse, Radio Moscow reportedly devoted one of its broadcasts yesterday to statements of Dobronravov, Soviet astrophysicist.

"'Technical and industrial possibilities for the construction of an automatically controlled satellite capable of a speed of 11 kilometers per second (necessary to reach the Moon and return to earth) now exist in the USSR,' the scientist reportedly stated.

"'With the launching of Sputnik III,' Professor Dobronravov emphasized, 'Soviet scientists became certain that the exploration of space does not have to be limited to the regions bordering the upper layers of terrestrial atmosphere. The launching of Sputnik III and of high-altitude rockets has proved,' added the scientist, 'that a vehicle can attain a speed of 11 kilometers per second with a standard chemical propellant. The equipment necessary for a 10-day cosmic trip for one or perhaps even two men can be placed on a cosmic vehicle with a weight equal to that of Sputnik III' continued Professor Dobronravov.

"'Cosmic flight of an automatically controlled manned vehicle which is capable of returning to earth,' continued the Soviet scientist, 'could not be accomplished except with the use of space suits necessary for the survival of man in cosmic space.'

"Professor Dobronravov concluded by stating that the achievements of Soviet science, technology, and industry allow the prediction that the trip to the moon 'will be possible in the near future.'" ("According to Radio Moscow, 'USSR Has Solved Problems in Construction of Automatically Controlled Sputniks'" Paris, L'Humanite, 23 Sep 58, p 8).



Soviets Report on Physiological Studies in Upper Atmosphere

The following is a complete translation of the article "Physiological Investigations in the Upper Atmosphere," by V. Malkin, Candidate of Medical Sciences, which appeared in a recent issue of the Soviet newspaper Meditsinskiy Rabotnik.

The creative genius of Soviet scientists is continuously advancing and opening up new vistas. Recently, the latest achievement broadcast throughout the world was the launching of a single-stage, 1,690 kilogram geophysical rocket by Soviet scientists in connection with the current IGY. In addition to the geophysical equipment, power supply, and radio apparatus, the rocket carried a hermetically-sealed cabin containing two experimental dogs, "Belyanka" and "Pestraya," medicobiological instruments which recorded the animals condition, and a motion picture camera.

"These achievements are the result of systematic research in the fields of medicine and biology carried on in rockets during the past 10 years.

"Scientists of many lands who attended the Fifth IGY Assembly in Moscow followed the results of scientific research conducted with the aid of Soviet artificial earth satellites and rockets. They showed interest not only in reports of Soviet scientists but also in the publications which were timed to coincide with the opening of the assembly.

"A collection of scientific works entitled, 'Preliminary Results of Scientific Research With the Aid of Soviet Artificial Earth Satellites and Rockets,' published by the Academy of Sciences USSR, contained a special section covering medical and biological research. The collection contained the following articles: 'Research on the Vital Activity of Animals During Flights in Hermetic Cabins of Rockets to an Altitude of 212 Kilometers'; and 'Research on Vital Activity of Animals During Flights in a Rocket Cabin Which Was not Hermetically sealed, to an Altitude of 110 Kilometers'. The titles alone give sufficient indication as to the character and extent of the research that has been conducted and of the increasing importance of aviation and space medicine. These articles indicate that medical and biological studies, during flights of rockets into the upper regions of the atmosphere, have been systematically carried on in the Soviet Union since 1949.

"To conduct research like this, required the joint efforts of physicians, physiologists, and engineers. The methods used ordinarily to record respiration, activity of the cardiovascular system, etc., could not be very well used in studies conducted in rockets flying through space. The special instruments needed for this purpose are instruments that are small in size and are protected from vibration, acceleration, and other factors encountered in flights at high altitude. The Soviet scientists invented a small set for use in aviation medicine. They used this set to record respiration, arterial pressure, and pulse beats of experimental animals in rockets flying in space. Valuable information was collected with the aid of these instruments. The construction of these instruments permitted certain parameters to be recorded telemetrically, i. e. transmitted by radio.

"A movie camera was used to photograph and evaluate the behavior of animals flying in space. Filming was done by means of a specially constructed movie camera with a focal length of 28 millimeters. The camera was installed in the upper section of the cabin; specular exposure was used in accordance with a method specially developed for this purpose.

"Soviet physiologists and technologists surmounted considerable difficulties in developing safety devices for the animals sent into the upper regions of the atmosphere. Some of the most important of these devices are hermetically sealed cabins, altitude suits, and catapult apparatuses.

"Throughout their flight in rockets up to altitude of 212 kilometers, the experimental animals were in a hermetic cabin located in the nose of the rocket. The shape of the hermetic cabin resembled that of a truncated cone, 460 liters in volume. It held two detachable cradles where the experimental animals were located regenerating equipment, and recording instruments. An injector regeneration system was used for air regeneration. A gas mixture, enriched with oxygen and compressed to 150 atmospheres, served as source of oxygen. The composition of the gas mixture was calculated in such a manner that normal conditions for breathing were provided when the barometric pressure in the cabin dropped to 460 millimeters of mercury; the oxygen content of the air in the cabin was maintained at level of about 37 percent, for that purpose.

"Before taking off, the dogs were given training to accustom them to conditions found in a hermetic cabin. Each animal was given a thorough clinical and physiological examination both prior to take-off and after the flight was over. This was necessary to evaluate any functional disturbance that may have taken place in the animals while flying in space.

"The rocket flights with the animals to an altitude of 212 kilometers lasted for 10-11 minutes. The maximum velocity achieved along the ascending trajectory of flight was 1.72 kilometers per second; along the descending trajectory, 1.75 kilometers per second (over 5,000 kilometers per hour). The nose of the rocket with the hermetic cabin, which held the two experimental animals, was separated from the body of the rocket at the upper point of the flight trajectory and, for a few minutes, was in a state of free fall down to an altitude of 4 kilometers. At this point a parachute in the nose of the rocket opened. The main parachute system came into play at an altitude of 2 kilometers. This main parachute system made it possible for the animals to be landed safely.

"Results of the physiological examinations of 14 dogs revealed that the hermetic cabin is dependable and can protect the animals against the harmful effects of the extremely low barometric pressure encountered in the upper regions of the atmosphere, and also against solar radiation. Changes in the circulation and respiration of the animals were principally due to acceleration and weightlessness. During take-off, when the animals inside the rocket were subjected to back to chest acceleration, an increase in pulse frequency was noted in all animals. Increase in respiration was also found in the majority of animals. During the period of weightlessness, the pulse frequency decreased, and increased again after the parachutes opened up and animals were subjected to deceleration.

"No substantial change was noted in the behavior of experimental animals under conditions of weightlessness. Examination of moving picture films revealed a sharp rise of the head during weightlessness. This apparently was due to the fact that the tonus of extensors of the neck and back ceased to be in conformity with the force of gravity.

"During the first few minutes of weightlessness, the blood pressure, pulse frequency, and respiration in the dogs remained high and became normal only after a lapse of 4-6 minutes. These data are of definite interest because up to now, on the basis of studies made by US scientists (Henry, Bellinger, Makhler, and Simons), it was thought that weightlessness causes a tendency toward a drop in blood presure.

"In evaluating the effects of various flight factors on experimental animals, the Soviet researchers came to the conclusion that the G forces create the most adverse effect on the organism during deceleration of the detachable part of the rocket. This explains why hemorrhage takes place into the sclera of the eyes, as well as the incidence of nose bleeding in some animals. Nevertheless, the animals were calm when they landed and their behavior was in no way unusual after the flight was over; they reacted quickly to situations, responded when called and ate their food avidly.

"Studies were also made of vital activity of animals which were sent up to an altitude of 110 kilometers in a cabin of a rocket that was not hermetically sealed. The effectiveness of an altitude suit against adverse effects of high altitude was tested. The altitude suit was made of a three-layer rubberized fabric; it represented a hermetic sack with closed sleeves for the front paws of the animal. The top section of the helmet was made of plastic and was in a form of a bell. Prior to take-off the animal, wearing the altitude suit, was made fast to the catapult, truck by means of a sliding cradle.

"When the rocket reached the altitude of 110 kilometers, its nose became detached from the body and began to fall freely. The animal occupying the first cart was catapulted out at an altitude of 75-90 kilometers at the end of the first 5 minutes of flight. The parachute opened up after 3 seconds of free fall. The second cart was catapulted at an altitude of 39-46 kilometers, at the end of 5 minutes of flight. It continued to fall freely to an altitude of 3.8 kilometers when the parachute system began to function. During catapulting and during the opening of the parachute system the animals were subjected to various overloads both as to magnitude and direction and, during the period of free fall, were in a state of weightlessness.

"Results of physiological studies (recordings of respiration and pulse beats) and photographs taken during these flights showed that the animals endured the effects of complex groups of overload factors and prolonged stay (up to 60 minutes) in altitude suits at high altitudes in a satisfactory manner. Changes in frequencies of heart contraction, respiration, and in magnitude of arterial pressure were not of a pathological nature: these changes quickly disappeared after the flight was over.

"Published reports show that Soviet scientists developed a method for selecting and preparing experimental animals for flights in rockets. A number of physiological methods were developed which made it possible to make a recording, under complex flying conditions, of the principal physiological functions of animals. Hermetic cabins have been developed and altitude suits invented which can be depended upon to protect animals from the effects of rarefied atmosphere and altitude. The possibility of saving the animals, flying at great speeds and altitudes, by means of a catapult was demonstrated.

"Medical and biological experiments with animals are important, because discoveries can be made which may help find ways by means of which a man can be sent in a rocket into space, both into upper atmosphere and beyond its limits, with safety and without impairing his normal vital activities." ("Physiological Investigations in the Upper Atmosphere," by V. Malkin, Candidate of Medical Sciences, Moscow, Meditsinskiy Rabotnik, 5 Sep 58)

## Moscow Planetarium Displays Soviet Meteorological Rocket

A meteorological rocket similar to those used in Soviet atmospheric investigations at high altitudes is currently being displayed to the public at the Moscow planetarium.

These rockets are described as single-stage liquid-fuel vehicles using solid propellant boosters during launching. Accurate scientific apparatus -- thermal and membrane manometers, resistance thermometers, bolometers, radio transmitters, batteries for power supply, miniature motion picture cameras -- and the parachute apparatus for lowering the nose cone and body section to Earth after termination of the flight are contained in the nose cone. ("Rocket in the Planetarium;" Moscow, Izvestiya, 18 Sep 58)

## III. UPPER ATMOSPHERE

### Sun Service in the Far East



Sunspots, faculae, chromospheric flares, prominences, and other physical phenomena and processes on the Sun are studied by numerous Soviet astronomical stations under the IGY program. Valuable investigations are conducted, in particular, by the station of the Service of the Sun of the Far East Branch of the Academy of Sciences USSR. The station is located on the summit of a high mountain 45 kilometers from Ussuriysk. Its geographical location thus is extremely favorable for studying the Sun and the upper layers of the Earth's atmosphere and for participating in observations of artificial earth satellites. A modern telescope for studying radio emissions from the Sun was recently installed in the Far East station.

A photograph accompanying the article is captioned: "M. A. Mitina, a laboratory worker of the Service of the Sun station, determines the intensity of solar chromospheric flares, photographed on film, with the aid of a microphotometer." ("Sun Service in the Far East," Nauka i Zhizn', No 8, Aug 58, p 38)





### Electrophotometric Studies of Night Sky Illumination in Leningrad University

The article "Electrophotometric Investigations of Night Sky Illumination," by L. G. Bol'shakova, Yu. N. Georgiyevskiy, A. N. Otto, and S. F. Rodionov, Leningrad State University and the Institute of Applied Geophysics, Academy of Sciences USSR, presents the following information.

The measurement of the change with time of the intensity of illumination is usually made according to points in electrophotometric investigations of night sky illumination. The increased photocurrent is measured by a galvanometer through determined intervals of time.

Investigations conducted at the laboratory of photometry of the Physics Institute of the Leningrad State University (LGU) showed that such investigations do not always reflect essential details of the change in time of the intensity of the measured radiation. This is particularly true for cases of extreme deviations from the even change of daily variations.

The problem of automatization for the continuous registration of photocurrents to obtain more detailed data on changes in the intensity of night sky illumination arose in connection with the IGY program.

The device used the FEU photomultiplier with subsequent increase of the photocurrent. An electrophotometer developed in LGU was used.

A shutter, open in working position, was located in the input of the photomultiplier, for controlling the zero value of the photocurrent. The shutter closed every 10 minutes for 40 seconds by means of a relay system working on a clock mechanism of the type used in thermographs or barographs.

For controlling the sensitivity of the instrument a standard lamp with a light filter could be switched on every 60 minutes by the same clock mechanism. The lamp's incandescence was controlled by means of a potentiometer.

The dot-recorder EPP-09 was used as a recording instrument after an alteration which made it possible to conduct continuous recordings in accordance with expeditionary conditions.

As a result of testing under expeditionary conditions, it was found that this method of continuous recording made it possible to detect maximums of night sky illumination which would not be discovered by the usual observations according to the point method (especially recommended for fulfillment of the IGY program).

The method is recommended for measuring night sky illumination as well as for other weak light flows.

Parallel measurements of the intensity of night sky illumination in the spectrum region of about one megacycle using the photometer with FEU were conducted in the summer and autumn months of 1956 at two different altitudes. The aim of the measurements was the determination of irregular variations in the transparency of the air with time in the layer between 2,200 and 3,900 meters above sea level in measured values of night sky illumination. Two identical installations were located in the El'brus at these altitudes.

It was established at that time that curves of diurnal variations obtained at the 3,900-meter level are to a considerable extent smooth in their change and that the curve of diurnal variation at the 2,200-meter level discloses irregular variations. This circumstance is essential in connection with the fulfillment of the IGY program of investigation of night sky illumination and auroras. The two-station work in El'brus will make it possible (to a certain degree) to take into consideration fluctuations of transparency in the lower layers of the atmosphere. This information was considered useful for other USSR stations conducting investigations of this nature under the IGY program. In addition, data obtained earlier on the magnitude of the weakening of the radiation of night sky illumination in the 2,200- to 3,900 meter level were confirmed. The magnitude of weakening fluctuated within the limits of 2.5-3 times for the one-megacycle region of the spectrum.

The authors report on experiments for determining the possibility of obtaining electrophotometric measurements of night sky illumination with a monochromator instead of the usual spectrographic method or with a sensitive electrophotometer with a light filter.

Infrared radiation of the night sky in the region of one megacycle was recorded in the autumn of 1956, with an FEU (cooled cesium oxide cathode) with a monochromator in place of a light filter. An M-1 monochromator from the experimental shops of the Physics Institute of Leningrad State University with a lens power of 1:4.5 and with a dispersion in the one-meter region of about 250 Å/millimeter was used.

Light signals from the night sky were obtained (using wide slits) which were approximately twice greater than the dark background of the photometer. Thus the signal from the sky was about 15 X $10^{-9}$a, and the fluctuation of the dark current about 7 X $15^{-9}$a at the output of the amplifier. The method used still does not give the possibility of measuring with the desired accuracy the distribution and structure of the spectrum of night sky illumination, but the results obtained make it possible to visualize that, with an increase of the lens power of the spectral system and the perfection of the method of cooling the FEU photocathode, the spectral electrophotometric method will prove to be considerably more effective than the usually applied method with light filters.

An accurate knowledge and the periodic control of such parameters of the electrophotometers being used as the spectral characteristics (in absolute units), the integral sensitivity with specific light filters, and the linearity of the whole electrophotometric system as a whole are particularly essential in measuring night sky illumination. The authors present a short description of several methods in this connection which are used in the photometric laboratory of the Physics Institute of the LGU. ("Electrophotometric Investigations of Night Sky Illumination," by L. G. Bol'shakova, Yu. N. Georgiyevskiy, A. N. Otto, and S. F. Rodionov, Leningrad State University and the Institute of Applied Geophysics, Academy of Sciences USSR, Izvestiya Akademii Nauk SSR, Seriya Geofizicheskaya, No 8, Aug 58, pp 1044-1047)

## Soviets Conduct Radar Investigations of Auroras at Roshchino

Radar investigations of auroras begun at Roshchino ($\varphi = 60^{\circ}12'$, $\lambda = 29^{\circ}34'$E, $\Phi = 56^{\circ}35'$, $\Lambda = 116^{\circ}47'$ E) in accordance with the IGY program are described by V. I. Pogorelov, Roshchino Station, Institute of the Physics of the Atmosphere, Academy of Sciences USSR, in an article entitled "Radar Images From Auroras," and by F. E. Martvel' and V. I. Pogorelov, in the article "The Connection of the Radiance of Auroras With Radar Images of Them."

The first article states that the observations were made around the clock on regular days and special world intervals every 15 minutes on the hour for each hour of the time zone and less systematically on other days.

The radar used had a carrier frequency of 72 megacycles, a pulse repetition rate of 50 cycles, and a power of 75 watts at impulse. The antenna was of the Yagi type.

Two types of signals were observed during the auroras: (a) a stationary or very shifting one, and (b) a rapidly moving one both with an increase as well as with a decrease of distance. Type b signals changed very little if at all in form during one or several sweeps across the scanner.

Graphs show the results of the distribution of the types (a and b) of images for hourly intervals and according to azimuth, and a diagram shows the distribution of the areas of separate registered images in relation to the slant range D of the azimuth E and the distribution of the number of images according to altitudes H of the reflecting regions.

An analysis of the results shows that the time of the maximum number of images coincides with the time of their greatest intensity.

The maximum number of images occurred at an altitude of 120 kilometers, that is, approximately in the zone of the location of the region of the most intensive parts of the auroras' radiance.

The declination of the magnetic field in the region of the auroras from normal corresponds well with ideas of currents creating spiral-form magnetic disturbances and with the distorted radiating structures of the auroras which sometimes appear. Inaccuracy in the determination of altitudes of reflecting regions can also appear as a result of not taking into account the refraction of radio waves by inhomogeneities in the ionosphere, where during auroras there always is an increased concentration of electrons.

The second article describes investigations of auroras at Roshchino by radar with simultaneous photographing with an automatic Stoffregen all-sky camera. The radar equipment was the same as described in the first article. Correct deciphering of the images on the motion-picture frames was possible only with the materials of simultaneous visual observations. To eliminate errors in the comparison of the auroras and radar images of them, only frames obtained on clear moonless nights were used.

The radar images were received on the whole from the north azimuth interval near the magnetic meridian passing through Roshchino. All the reflecting parts of the auroras observed at Roshchino closely satisfy Chapman's conditions according to which the directions of reflection are perpendicular to the mean location of the magnetic lines of force.

A table included in the article gives a compilation of the auroras and their radar images. Altitudes of the reflecting zones are calculated according to the slant distances for the greatest amplitude of signals with the condition that the reflections originate in the directions perpendicular to the magnetic lines of force which are a direct continuation of them from the Earth's surface. The material obtained is still not sufficient, and observations in clear moonless nights over a long period are necessary for the greater accumulation of information. ("Radar Images From Auroras," by V. I. Pogorelov, and "The Connection of the Radiance of Auroras With Radar Images of Them," by F. E. Mart'vel and I. V. Pogorelov, Roshchino Station, Institute of the Physics of the Atmosphere, Academy of Sciences USSR; Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 8, Aug 58, pp 1048-1051 and pp 1052-1053)

## IV. METEOROLOGY

### Automatic Meteorological Station Used by Soviet River Fleet

An automatic meteorological station, the ARIV-52, was placed in August in the Kubyshevsk water reservoir, where it will be used in the service of the river fleet.

The apparatus is mounted on a buoy. It is equipped with a transmitter capable of sending coded signals on air temperature and humidity, wind speed and direction, and water temperature for a distance of up to 100 kilometers. The ARIV-52 transmits its information four times per day and in winds of 6 meters per second, hourly.

The device is manufactured by the Scientific Research Institute of the Hydrometeorological Service under the supervision of Magil'ner, its chief engineer.

Two more such installations are planned for the Kubyshevsk water reservoir for 1959. ("Automatic Weather Station," Moscow, Izvestiya, 28 Sep 58)

## V. ARCTIC AND ANTARCTIC

### Soviet Automatic Meteorological Stations on Polar Drift Ice

A Pravda article reports that the diesel-electric ship Yenisey is now in the Central Polar Basin. Here for the first time under autumn conditions two drifting automatic radiometeorological stations were established on drift ice. ("Here and There," Moscow, Pravda, 28 Sep 58)

### Moscow Conference on Antarctic Research

At the recent Moscow meeting of the Special Committee for Antarctic Research (SCAR), recommendations were made to increase the number of antarctic stations of all countries participating in antarctic research. For this purpose, the committee indicated the regions where it would be desirable to open new stations at this time. These regions include the coast of West Antarctica, between Ross Sea and Graham Land (one station), the coast of Wilkes Land (2 stations), the coast of Queen Maud Land (ore station), the interior regions between latitudes 75-80 degrees (5 stations), and the islands between latitudes 45-65 degrees (3 stations). At the same time the suggestion was made to expand the program of observations in the Antarctic Ocean within the sphere of interest of SCAR.

With regard to the mapping of Antarctica, the Soviet delegation submitted the draft of a resolution recommending to the participating countries that a uniform plan be agreed on for taking aerial photographs of the whole antarctic continent and for compiling a single map of Antarctica with a scale of 1:3,000,000. A working group for cartography will be formed to coordinate this project, headed by Dr Laclavere of France. Dr Wechsler of the US will be in charge of the preparation of a catalogue of existing maps on Antarctica.

The special committee approved a decision for the publication of an information bulletin of SCAR, which will contain material devoted to the activities of SCAR and its working groups, the organization and conduct of antarctic expeditions, and the results of scientific research work of these expeditions. The bulletin will be published in Russian and English. At the suggestion of representatives of Great Britain and the USSR, the bulletin will be printed by the Polar Scientific Research Institute at Cambridge and the Arctic and Antarctic Institute of the Main Administration of the Northern Sea Route, Ministry of Maritime Fleet, in Leningrad.

The next meeting of SCAR will convene in Melbourne, Australia, at the same time as the symposium on meteorological research in the Antarctic during February-March 1959. A general antarctic symposium on the results of research during the IGY will be held in November 1959 in Buenos Aires, Argentina. ("Conference of the Special Committee for Antarctic Research," by A. Nudel'man, Moscow, Vodnyy Transport, 9 Sep 58)

## Antarctic Flights in September

During September, planes from Mirnyy made two flights with landings to the station Oazis; they also made several weather reconnaissance flights over the continent, and recently transported a group of hydrologists to the West Shelf Ice at a distance of 280 kilometers from Mirnyy. Some interesting oceanographic research was conducted at this place. On 10 September, an Il-12 plane made a long-distance flight on the route Mirnyy-Pionerskaya-Komsomol'skaya-Oazis-Mirnyy. ("Spring Begins in Mirnyy," Moscow, Vodnyy Transport, 20 Sep 58)

## Geological Research in Antarctica

Geological studies in Antarctica began in the area of Mirnyy during 1956. At the beginning of the antarctic summer (December), a thorough study began of the oasis located about 400 kilometers from Mirnyy, which had been discovered from the air by the American pilot Bunger in 1947.

During the spring and summer of 1957, new groups of polar scientists landed on the shores of East Antarctica. Soviet geologists have advanced almost as far as the mountains of southern Victoria Land, where US scientists are working, and Queen Maud Land, where the Japanese station is located. On the basis of these preliminary studies, it is possible to form definite plans regarding the regions where further geological research is advisable.

Planes and helicopters have flown geologists to the foothills of rocky mountains and stony oases. Soviet explorers have been able to explore the most inaccessible mountain peaks and penetrate many parts of the antarctic coast.

A number of interesting geological discoveries were made on these exploratory trips into the regions of East Antarctica during the spring and summer periods from 1956 to 1958. A study was made of one of the oldest strata of crystalline shale existing on the Earth, which is over 15 kilometers thick. In addition to the usual gneisses, large seams of marble and quartz were discovered at this location.

Enormous rock formations of granite of the type of Indian charnockites and Finnish rapakiwi have been discovered. Pegmatitic veins containing mica and rich veins of excellent iron ore were connected with these granites. Large accumulations of boulders have formed around the mountains and oases, among which fragments of magnetitic quartzites and shales can be found for hundreds of kilometers, testifying to the presence of a large iron-ore basin concealed under the ice cap.

Geologists have discovered hundreds of steep veins of comparatively young Karroo dolerites cropping through the crystalline shales. It is interesting to note that in South Africa and in the northern part of the Yakutskaya ASSR rich diamond deposits have been found in rocks closely related to those discovered in Antarctica. Thus, not far from the South Pole, rocks have been encountered which are characteristic for India, Finland, South Africa, and the north of the Yakutskaya ASSR.

In studying the rocks of the original antarctic bed (lozhe), emerging from under the glacial cover, the Soviet geologists were able to determine a whole number of natural laws in the geological structure of Antarctica which have great scientific significance.

Even though the IGY is coming to an end, antarctic research will be continued. It appears that in the next few years basic research in Antarctica will be devoted to glaciology and geology. Soviet geologists intend to continue their work first of all to the west of the regions previously explored. ("Secrets of Antarctica," by Prof M. Ravich, Moscow, Trud, 17 Jul 58)

## Food Supplies for Antarctic

Special food supplies are being prepared for the Fourth Soviet Antarctic Expedition. The Riga Meat Combine has prepared meat products formed into blocks and packed in multilayer, insulated containers. The best temperature for preserving these products is constantly maintained inside the containers and the meat does not lose its taste even after many months.

Creamery butter for the polar explorers is also made by a different recipe from that used for the butter ordinarily sold in stores. It is vitamin-enriched with a yeast concentrate and is adapted to long periods of storage. Macaroni products are made of special flour, with reduced moisture content and low acidity.

Fresh fruit is arriving in large quantities in the warehouses specially assigned for supplying food to the expedition. According to past experience, the fruit is carefully packed, and the members of the expedition will be able to eat fresh apples, oranges, lemons, and mandarins, and all kinds of canned fruit, in the same condition as at the time of loading on the ships.

Each box, bag, or container, bears an inscription in indelible ink indicating the name of the scientific station for which the freight is intended. ("Food Production for Polar Explorers," by V. Lushchevskiy, Moscow, Vodnyy Transport, 25 Sep 58)

New Houses for Antarctica

The Zharkovskiy Plant for Prefabricated House Building has been supplying houses for antarctic expeditions since 1955. Several hundred houses for living and working quarters have already been produced.

On 12 September, the plant sent a new shipment of houses to the Antarctic. At present, houses are being shipped which are to be used as living quarters of the new Soviet antarctic stations Lazarev and Bellinghausen, to be established by the Fourth Antarctic Expedition of the USSR. ("House Builders -- to the Explorers of Antarctica," Moscow, Izvestiya, 2 Oct 58)

* * *